MODELLING OF THE FATE OF RADIONUCLIDES IN URBAN SEWER SYSTEMS AFTER CONTAMINATION DUE TO NUCLEAR ACCIDENTS

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After an accidental radioactive contamination by aerosols in inhabited areas, the radiation exposure to man is determined by complex interactions between different factors such as dry or wet deposition, different types of ground surfaces, geochemical properties of the radionuclides involved and building development.
After rainfall events deposited radionuclides are washed out from surfaces and in urban areas the resulting contaminated runoff enters the sewer system.
Up to now the potential exposure caused by this process has received little attention. Therefore, it is estimated here with simulation models. The urban rainfall-runoff model KANAL++ (www.tandler.com) has been extended to include the transport of radionuclides from surfaces through the canalisation to various discharge facilities. Flow and transport on surfaces is modelled by unit hydrographs, which produce boundary conditions for a system of 1d coupled flow and transport equations in a tube network. Initial conditions are given by maps of surface contamination which are produced by geo-statistical interpolation of hypothetical measurements of the gamma dose rate taking into account the detector environment. The corresponding methodology is implemented in the IAMM software module as part of the European decision system JRODOS. The transition of deposited nuclides into the surface runoff is accounted for by nuclide-specific entrainment coefficients. Simulation results for a hypothetical scenario based on realistic urban data are presented.
Calculations are carried out to quantify the exposure to workers of a water treatment plant, the amount of radioactivity that may affect water used in irrigation and drinking water. The estimated exposure levels are compared to limits imposed by national and international regulations for radiation protection.